

TECHNICAL NOTES

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS.

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No. 180

INCREASING THE COMPRESSION PRESSURE IN AN ENGINE BY
USING A LONG INTAKE PIPE.

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INCREASING THE COMPRESSION PRESSURE IN AN ENGINE BY
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During some tests of a one-cylinder engine, using gas oil (Diesel engine oil, specific gravity 0.86 at 60°F.) with solid injection and compression ignition, it was found necessary to increase either the jacket water temperature or the compression pressure in order to start the engine. It was found that sufficient increase in compression pressure could be obtained simply by attaching a long pipe to the inlet flange of the cylinder. However, since no data were available giving the values of the increase in compression pressure that might be expected from such a set-up, an investigation was made covering some engine speeds between 500 R.P.M. and 1800 R.P.M.

The data obtained during this investigation are included in this paper in the form of curves. Although this data is not strictly applicable to another engine, it should give indications of what might be expected with such a set-up on an engine operating at the speeds here covered.

The engine used was a single cylinder Liberty, 5" bore and 7" stroke, having standard cylinder, cams, valves and valve timing and operating on the four-stroke cycle. The exhaust

valve closed and the inlet valve opened at 10 degrees past top dead center. The inlet valve remained open until 45 degrees past bottom dead center. The piston was special, giving a volumetric compression ratio of 11.4 : 1. The long inlet pipe or "ram" was made in two sections. The section nearest the engine was about 2 1/4" inside diameter and was bolted to the inlet flange of the cylinder. A gasket made this connection practically air tight. The other section of pipe was about 2 1/8" inside diameter (same diameter as hole in inlet flange), and telescoped into the section attached to engine. The joint between sections was taped to prevent air leakage.

The pipe was open to the atmosphere with no obstruction such as a carburetor or butterfly valve. The only obstruction to direct flow of air into the cylinder, apart from the natural restriction of the valve port, was the almost right angled turn, inherent in the cylinder design, above the valve seat.

During the tests, the engine was motored over with the dynamometer and especial care was exercised to maintain a constant speed while a pressure reading was being determined. The readings were made with an Okill pressure gage, and, since the air temperature at the end of compression could approach 650 degrees F., the body of the gage, containing the piston and spring, was kept comparatively cool by means of wet cloths. Some check readings made with this gage during the same runs showed a maximum discrepancy of 2 per cent. The jacket water

was kept about 100 degrees F. for all the runs, which condition favored the maintenance of a uniform oil seal between the piston and cylinder.

Five curve sheets are given. The constant R.P.M. curves on Figures 1 and 2 show the relation between the length of intake pipe and the final compression pressure. The curves for these figures are drawn through the data points to emphasize small variations in the compression pressure that might actually exist but which would be lost in a faired curve. The points widely separated from the general trend of the curve were checked, which fact seemed to be a sufficient reason for incorporating one set of curves drawn through the data points. The curves of Figures 3 and 4 are drawn for the same data points as shown on Figures 1 and 2, but for these curves the points are faired. The curves on Figure 5 are crossplots of the faired curves on Figures 3 and 4, and show more clearly the variation in compression pressure with R.P.M. for a given length of intake pipe.

It will be noticed that in one case, at 1400 R.P.M., with a 62" length of pipe, the compression pressure is 382 lb./sq.in., or about 17 per cent greater than the compression pressure at the same speed but with no pipe.

It might be well to emphasize that the volumetric compression ratio remained the same during these tests. Hence, there was no change in temperature such as would occur with a change in volumetric compression ratio; the increase in compression

Fig.1.

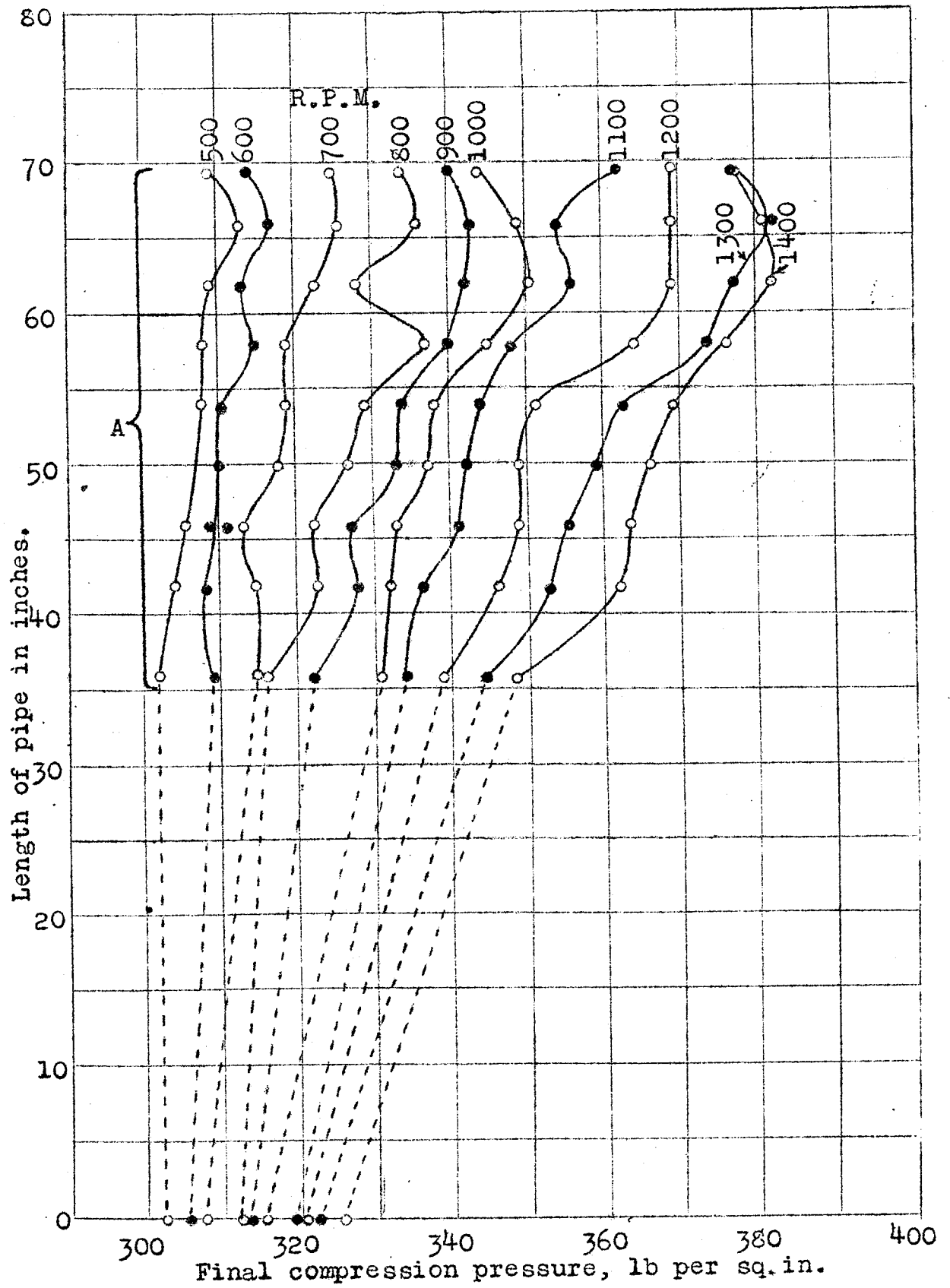


Fig.1.

Fig.2.

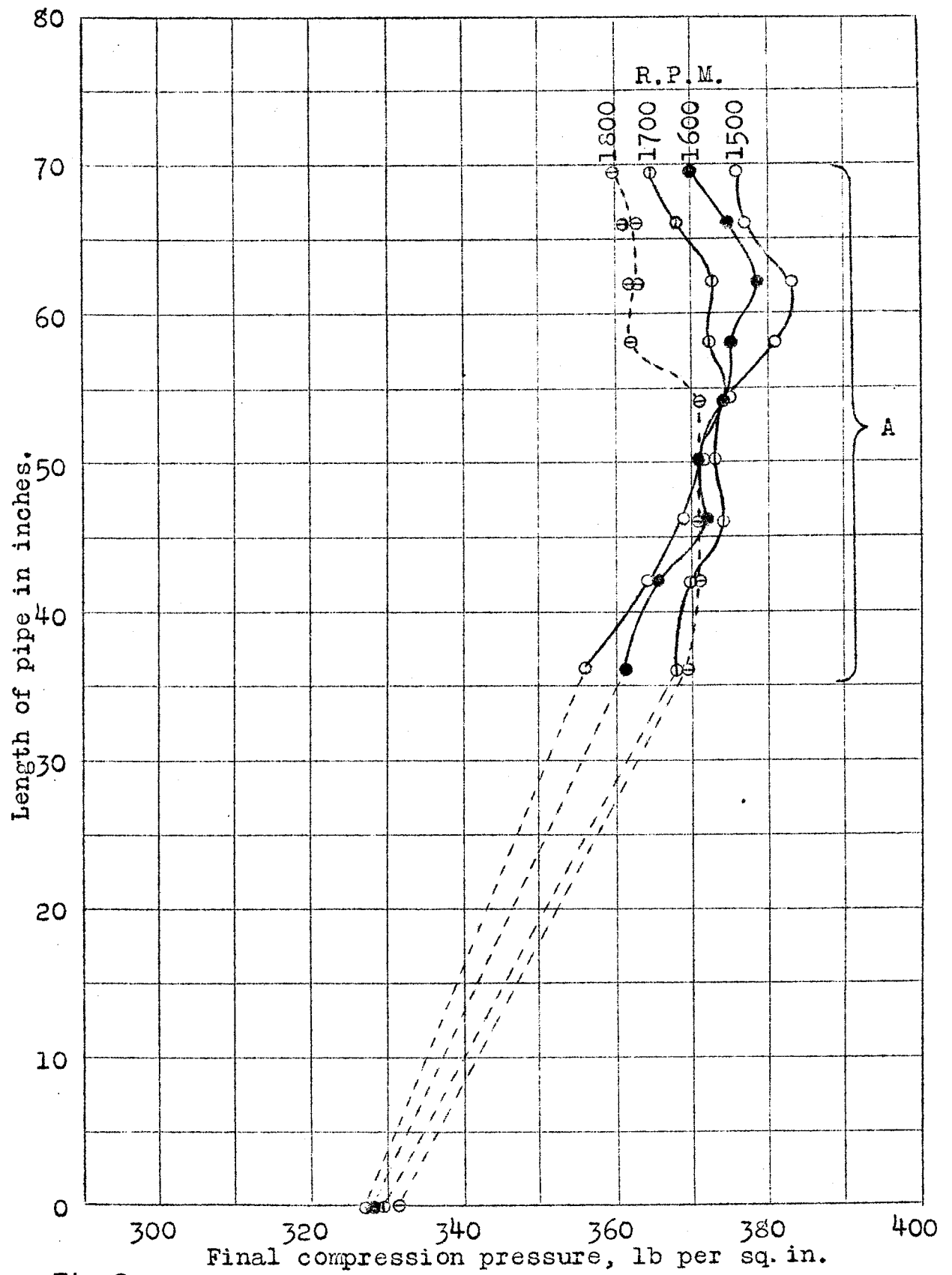


Fig.2.

Fig.3.

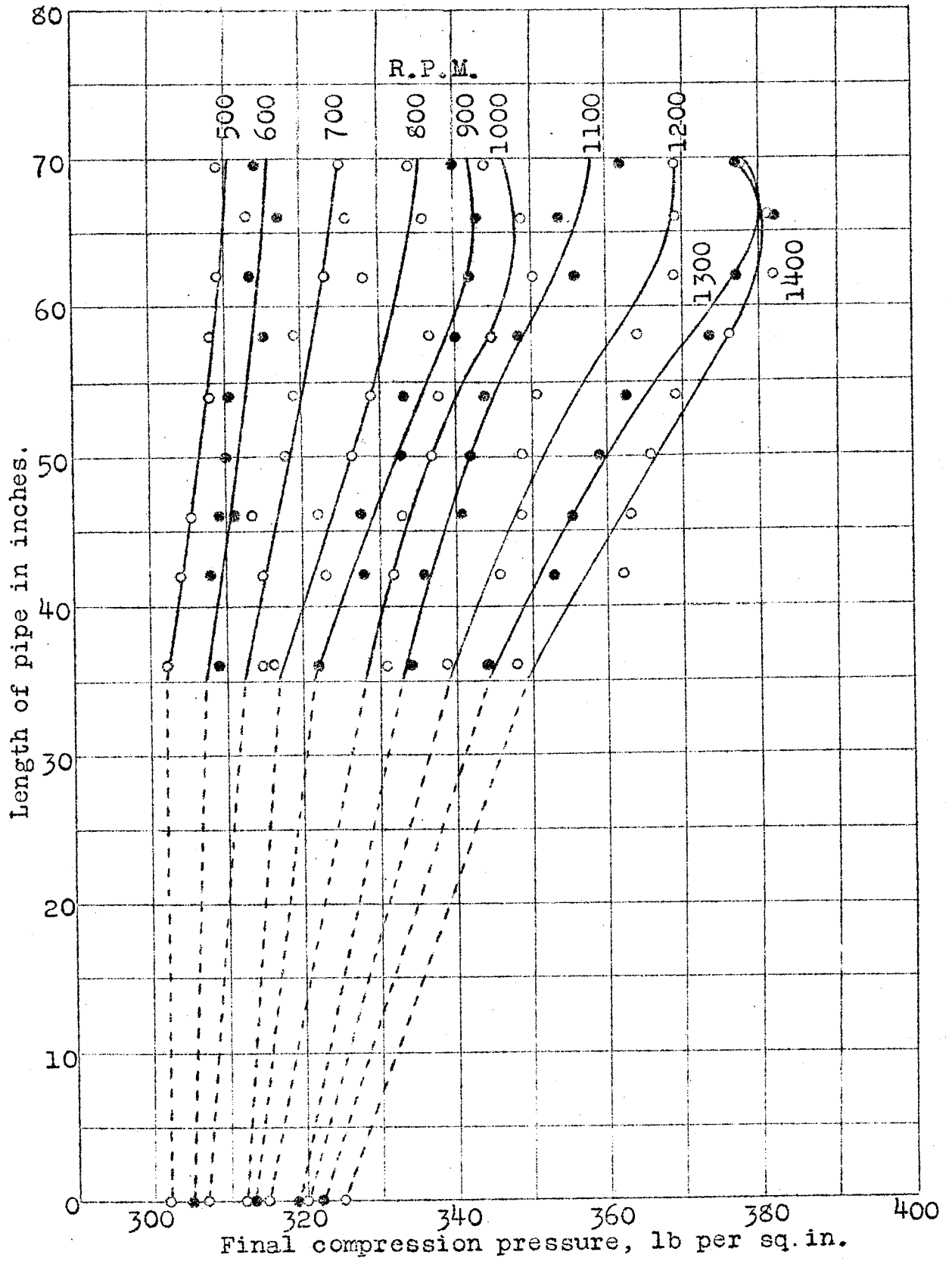


Fig.3.

Fig.4.

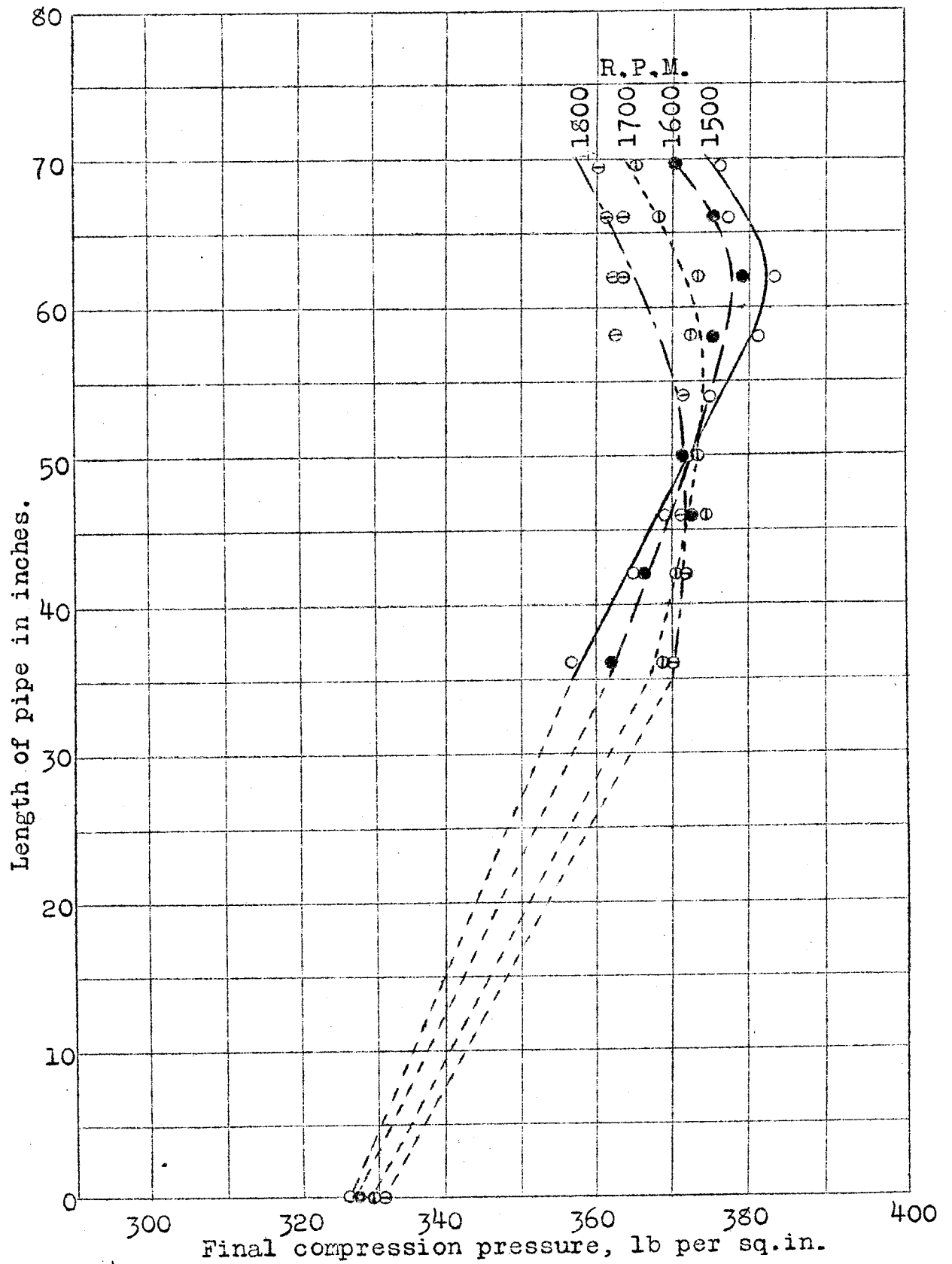


Fig.4.

Fig.5.

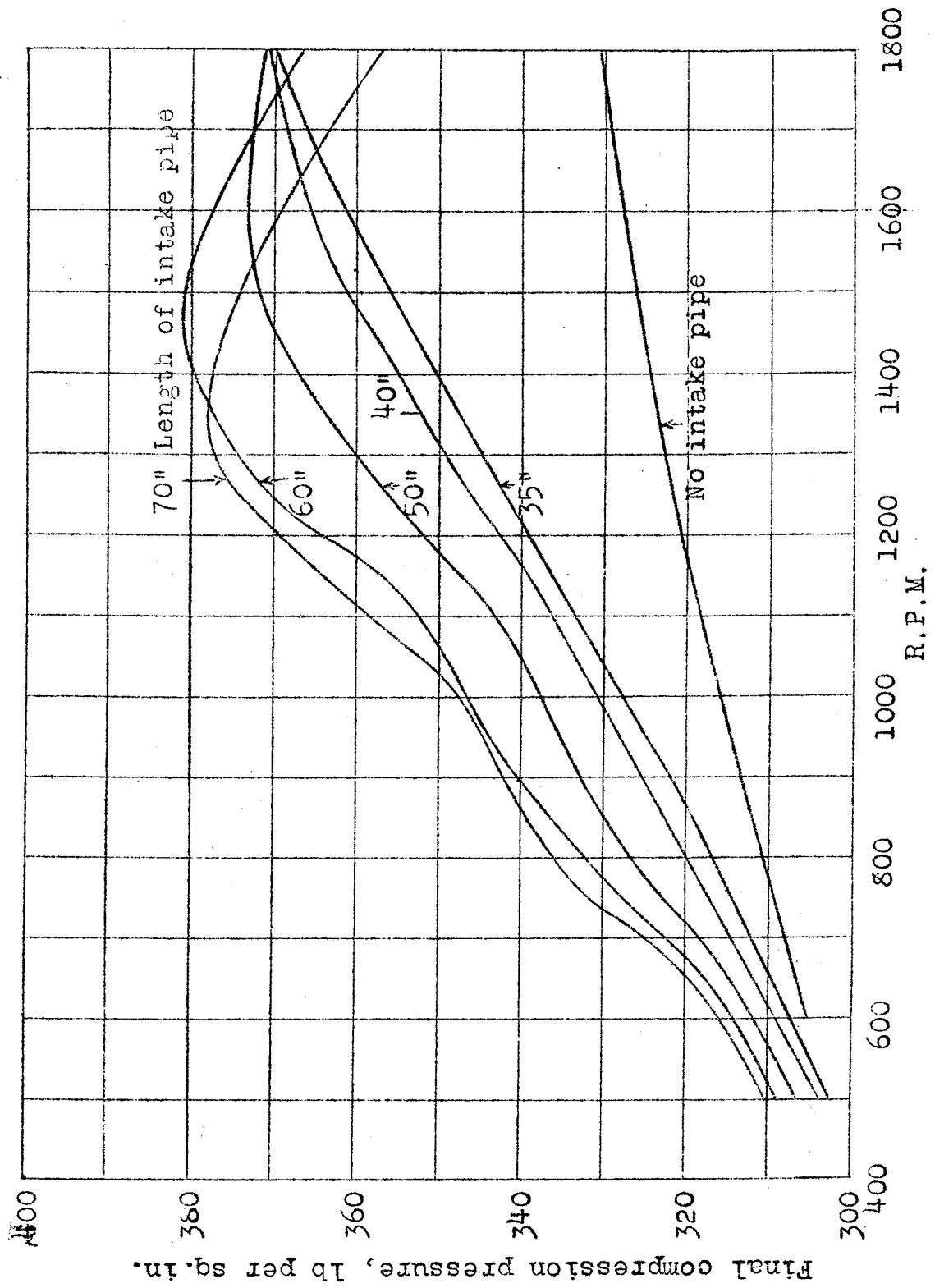


Fig.5.

